DRUG RESISTANCE

Subject: Science | **Current:** 2010 | **Grade:** 9-12 **Day:** 2 of 2

1 Purpose

To illustrate the causes and effects of bacteria drug resistance.

2 Duration

50 minutes

3 Additional Topics

Bacteria, Antibiotics, and Health Issues

4 Objectives

At the end of this lesson, students should be able to:

- Analyze the effectiveness of antibacterial soap and hand sanitizer.
- Describe the beneficial uses of microorganisms
- Identify sources of antibiotics in the environment

5 Standards & Benchmarks

BIOLOGY

Recognize and explain how the many cells in an individual can be very different from one another, even though they are all descended from a single cell and thus have essentially identical genetic instructions. Understand that different parts of the genetic instructions are used in different types of cells and are influenced by the cell's environment and past history. **B.1.1**

Understand and describe how the maintenance of a relatively stable internal environment is required for the continuation of life and explain how changing physical, chemical, and environmental conditions, as well as the presence of disease agent's challenges stability. **B1.17**

Describe how natural selection provides the following mechanism for evolution: Some variation inheritable characteristics exist within every species, and some of these characteristics give individuals an advantage over others in surviving and reproducing. Understand that the advantaged offspring, in turn, are more likely than others to survive and reproduce. Also understand that the proportion of individuals in the population that have advantageous characteristics will increase. **B1.31**

HEALTH & WELLNESS

Examine how public health policies and government regulations can influence health promotion and disease prevention. **HW.2.10**

Indiana Department of Education. (n.d.). Indiana Standards and Resources: Sciences: Biology; Health & Wellness. Retrieved from http://dc.doe.in.gov/Standards/AcademicStandards/StandardSearch.aspx

6 Vocabulary

Students should be familiar with the following terms:

- **Antibacterial**: Destructive to or inhibiting the growth of bacteria.
- **Antibiotic Resistance**: The ability of bacteria to withstand the effects of antibiotics.
- **Pharmacoepidemiology**: The study of how people use medicines.

7 Materials

The following materials are used in the lesson:

- "Microbes: What They Do and How Antibiotics Change Them"- http://www.actionbioscience.org/evolution/meade_callahan.html
- Petri Plates w/ Bacterial Growth from Lesson 1
- The Effectiveness of Antibacterial Products Lab Handout (includes lab, assessment, & rubric)

8 Procedures & Methods

A. Introduction

Antibacterial and antimicrobial agents were created to prevent the spread of infection and were first introduced to doctors and nurses working in large health institutions. Later large companies began marketing these products to everyday consumers. The effectiveness of antibacterial products is in question and being researched to determine if the overuse of the products is a leading factor in drug resistance among bacteria. Arguments made against antibacterial products include the possibility that although the products kill harmful bacteria, the products also kill bacteria that provide benefits to everyday consumers.

B. Development

After the introduction, review with students the purpose of the lab in testing the effectiveness of the antibacterial products. Quickly review the procedures taken in lesson 1 to prepare for today's lesson. Many variables exist with the results and must be pointed out when discussing the outcome of the bacterial growth. As students gather their Petri plates, have students to think about the following questions:

- What objects did they come into contact with prior to providing the bacterial sample?
- Based on the growth of bacteria in all three samples, which method of hand washing is the most effective?
- What disadvantages exists with the use of antibacterial soaps?
- What additional studies can be conducted to determine the effectiveness of antibacterial soaps?
- Should the production of antibacterial products be banned based on the threat they may pose to the health of the public?

Activity should take approximately 20 minutes.

C. Independent Practice

Students will read the article, "Microbes: What They Do and How Antibiotics Change Them," and begin discussing the following questions:

- How are bacteria beneficial to the environment?
- How are bacteria beneficial to our health?
- How do antibiotics get into the environment?
- Why is it pointless to take antibiotics for the common cold and flue?
- What are some ways to reduce the drug resistance problem?
- Explain how bacteria develop the ability to become antibiotic resistant?

D. Practice

The remaining part of the lesson will take place outside of the classroom. Students will be assessed on their understanding of the material by producing an individual product described in more detail in "The Effectiveness of Antibacterial Products" Lab handout. (attached)

E. Accommodations (Differentiated Instruction)

ELL students may need to have lab instructions translated into their primary language. Students with visual impairment may need to have the instructions read and some guidance in placing their hands on the Petri dish. Products for the assessment have been differentiated to provide students a choice of visual, oral, or written products.

G. Closure

Careers Involved in Drug Resistance:

- **Center for Disease Control**
  http://www.cdc.gov/employment/menu_topjobs.html

  • Physicians
  • Pharmacists
  • Public Health Advisors
  • Epidemiologists
  • Microbiologists

9 Evaluation

Students will be evaluated on their individual product developed from the "The Effectiveness of Antibacterial Products" Lab, assessment section.

10 Teacher Reflection

To be completed by teacher following the lesson.

11 Resources & Media

Rescources for the lesson:

- http://health.howstuffworks.com/antibacterial-soap-outlawed.htm
- http://www.pbs.org/wgbh/evolution/educators/lessons/lesson6/act1notes.html
- http://www.cdc.gov/employment/menu_topjobs.html
- "Microbes: What They Do and How Antibiotics Change Them"- http://www.actionbioscience.org/evolution/meade_callahan.html
- Petri Plates w/ Bacterial Growth from Lesson 1
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THE EFFECTIVENESS OF ANTIBACTERIAL PRODUCTS LAB

A. Overview

Hand washing is the easiest and most effective manner individuals can use to prevent the spread of bacteria and illnesses. The question remains whether it is more beneficial to use products labeled as antibacterial or to simply use regular soap and water. Research suggests that the use of antibacterial products kills both the harmful and beneficial bacteria and promotes bacteria's ability to become drug resistant. The purpose of this lab is to determine whether antibacterial products are more effective than simply washing hands with regular soap and water.

B. Materials

- Prepared Petri dishes
- Antibacterial Soap (Germ-X)
- Regular Soap (Dove)
- Safety Goggles

C. Procedure

Day 1

1. Students need to get into groups of three students and obtain 3 Petri Plates. (Be sure not to open the Petri Plates until it is time to provide your bacteria sample!)
2. One student will touch the prepared Petri dish without washing his/her hands by gently pressing his/her four fingers onto the agar.
3. One student will wash his/her hands with the regular soap and water and then do exactly as student one using another prepared Petri plate.
4. The last student will wash his/her hands with the Germ-X and do as the other students with the last Petri plate.
5. Label all Petri Plates with student's name and what type of soap was used.
6. Place the Petri plates inside your lab cabinet.
7. Clean up your lab area and return to your desk.

Day 2 (It may take more than 1 day for bacteria to grow)

1. Obtain your hree Petri plates and observe the amount of bacteria growth on the plates by simply counting the colonies present.
2. Consider these questions:
    - Which plate has the most growth?
    - Which cleaner seems to be the most effective?
    - What variables exist in this lab?
3. Record observations in your notebook and clean up the lab area.
4. Make sure to wash hands before leaving the classroom.

D. Assessment

Based on the lab results and the content discussed during the past two lessons, You will demonstrate knowledge pertaining to drug resistance through a project. You may use the article, "Microbes: What They Do and How Antibiotics Change Them," but you must also obtain two other resources to aid in the research aspect of the project. You may choose from any of the following assignments:

1. As a local news producer, design a two-three minute video on the dangers of antibiotic resistance, how bacteria become antibiotic resistant, and how it can be reduced.
2. Create a brochure on the benefits of bacteria to the environment and health of the public as well as safe hand washing procedures to reduce the spread of illnesses.
3. Write a lab report over "The Effectiveness of Antibacterial Products" Lab using standard lab report format.
4. Create a visual presentation to illustrate the actual drug resistance mechanisms.
5. Conduct a neighborhood survey on the public's use of antibiotics or antibacterial products and illustrate findings through a report or a public awareness commercial.
6. Develop an educational program on the important of antibiotic use and drug resistance for a group of elementary education students.

Category	Superior – 5 pts	Good – 3 pts	Poor – 1 pt
Product	Product demonstrates a thorough understanding of the content.	Product demonstrates an average understanding of the content.	Product demonstrates a poor understanding of the content.
Sources	3 or more sources were used in researching topic.	2 sources were used in researching topic.	1 source was used in researching topic.
Creativity	Product displays creative and visibly appealing material.	Product displays an average use of creativity and visibly appealing material.	Product lacks creativity and visible appeal.
Grammar	0-3 grammatical errors exist.	4-8 grammatical errors exist.	9+ grammatical errors exist.
Points per Column			

Total Points: _____